Imazapyr

HERBICIDE FACT SHEET

U.S. DEPARTMENT OF ENERGY
BONNEVILLE POWER ADMINISTRATION

This fact sheet is one of a series issued by the Bonneville Power Administration for their workers and the general public. It provides information on forest and land management uses, environmental and human health effects, and safety precautions. A list of definitions is included in Section VIII of this fact sheet.

I. BASIC INFORMATION

COMMON NAME: imazapyr

CHEMICAL NAME: 2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1-H-imidazol-2-yl]-3-pyridinecarboxylic acid

Cas No. 81334-34-1

CHEMICAL TYPE: imidazolinone

PESTICIDE CLASSIFICATION: herbicide

REGISTERED USE STATUS: "General Use."

FORMULATIONS: Commercial herbicide products generally contain one or more ingredients. An inert ingredient is anything added to the product other than an active ingredient. Because of concern for human health and the environment, EPA announced its policy on toxic inert ingredients in the Federal Register on April 22, 1987 (52FR13305). This policy focuses on the regulation of inert ingredients. EPA's strategy for implementing this policy included the development of four lists of inerts, based on toxicological concerns. Inerts of toxicological concern were placed on List 1. Potentially toxic inerts/high priority for testing were placed on List 2. Inerts of unknown toxicity were placed on List 3, and inerts of minimal concern were placed on List 4.

The inert ingredients of the imazapyr formulations are not classified by the USEPA as inert ingredients of toxicological concerns to humans or the environment.

The contents of the imazapyr formulation are listed below:

Arsenal® Herbicide Imazapyr 28.7 % Inert 71.3 %	Arsenal® Applicators Concentrate Herbicide Imazapyr 53.1 % Inert 46.9 %
Arsenal® Railroad Herbicide Imazapyr 27.6 % Inert 72.4 %	Chopper® Herbicide Imazapyr 27.6 % Inert 72.4 %

RESIDUE ANALYTICAL METHODS: Capillary Electrophoresis Method 2657.

II. HERBICIDE USES

REGISTERED FORESTRY, RANGELAND AND RIGHT-OF-WAY USES: Imazapyr is registered for use in non-crop sites for selective and total weed control. For terrestrial use only.

OPERATIONAL DETAILS:

TARGET PLANTS: Imazapyr is used for pre- and post-emergent control of annual and perennial grasses and broadleaf weeds, brush, vines, and many deciduous trees.

MODE OF ACTION: Imazapyr is absorbed by the leaves and through the root system, disrupting protein synthesis.

METHOD OF APPLICATION AND RATES Aerial and ground broadcast, spot and localized applications at 2 to 6 pints per acre.

SPECIAL PRECAUTIONS:

TIMING OF APPLICATION: Timing is dependent on the target plant.

DRIFT CONTROL: Care should be exercised not to overspray or apply the herbicide to adjacent non-target areas. Drift control is achieved by observing weather conditions and following label and sprayer instructions. Spray droplet size should be 150 microns or larger.

RESTRICTIONS/WARNINGS/LIMITATIONS: Do not use on food or feed crops. Do not treat irrigation ditches or water used for irrigating crops.

III. ENVIRONMENTAL EFFECTS/FATE

SOIL:

RESIDUAL SOIL ACTIVITY: The half-life of imazapyr is 90 days.

ADSORPTION: The K(oc) of imazapyr is 100.

PERSISTENCE AND AGENTS OF DEGRADATION: Imazapyr is moderately persistent in the plant and soils. The primary route of degradation is microbial activity.

METABOLITES/DEGRADATION PRODUCTS AND POTENTIAL ENVIRONMENTAL EFFECTS: No information.

WATER:

SOLUBILITY: 1.0 mg/l in water (pH 7 at 25° C).

POTENTIAL FOR LEACHING INTO SURFACE AND GROUND WATER: Imazapyr is moderately persistent with a moderate soil adsorption coefficient. There is a moderate potential for imazapyr to leach into groundwater and a high potential for surface water runoff.

AIR:

VOLATILIZATION: No information.

POTENTIAL FOR BYPRODUCTS FROM BURNING OF TREATED VEGETATION: Not known.

IV. ECOLOGICAL TOXICITY EFFECTS ON NON-TARGET SPECIES

MICROORGANISMS:

ACUTE CONTACT TOXICITY: LD_{50} (honey bee contact) >100 µg/bee

OVERALL TOXICITY: Practically Non-Toxic

PLANTS: Contact will injure or kill target and non-target plants.

AQUATIC VERTEBRATES:

ACUTE TOXICITY: LC_{50} (rainbow trout 96-hour) >100 mg/l

ACUTE TOXICITY: LC_{50} (bluegill sunfish 96-hour) >100 mg/l

OVERALL TOXICITY: Practically Non-Toxic

AQUATIC FRESHWATER INVERTEBRATES:

ACUTE TOXICITY: LC_{50} (*Daphnia magna* 48-hour) >100 mg/l

OVERALL TOXICITY: Practically Non-Toxic

AQUATIC ESTUARINE/MARINE INVERTEBRATES:

ACUTE TOXICITY: LC_{50} (sheepshead minnow 96-hour)
ACUTE TOXICITY: LC_{50} (grass shrimp 96-hour)

ACUTE TOXICITY: LC_{50} (eastern oyster 96-hour)

OVERALL TOXICITY: Practically Non-Toxic (Based on freshwater data, imazapyr is not expected to be toxic to estuarine invertebrates.)

TERRESTRIAL ANIMALS:

AVIAN ACUTE ORAL TOXICITY: LD_{50} (bobwhite quail) >2150 mg/kg

AVIAN ACUTE ORAL TOXICITY: LD_{50} (mallard duck) >2150 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (bobwhite quail) >5000 mg/kg

AVIAN SUBACUTE DIETARY TOXICITY: LC_{50} (mallard duck) >5000 mg/kg

MAMMAL ACUTE ORAL TOXICITY: LD_{50} (rat) >5000 mg/kg

OVERALL TOXICITY: Practically Non-Toxic

BIOACCUMULATION POTENTIAL: Little Potential

THREATENED AND ENDANGERED SPECIES: Federally listed terrestrial and aquatic plants may be adversely affected if the product is applied directly to the plants, or indirectly as the result of drift or leaching.

V. TOXICOLOGICAL DATA

ACUTE TOXICITY:

ACUTE ORAL TOXICITY: LD_{50} (rat) >5000 mg/kg

ACUTE DERMAL TOXICITY: LD_{50} (rabbit) >2000 mg/kg

PRIMARY SKIN IRRITATION: Rabbit - Slight Irritant

PRIMARY EYE IRRITATION: Rabbit – Moderate Irritant

ACUTE INHALATION: LC_{50} (rat) >1.3 mg/l

OVERALL TOXICITY: Category III – Slightly Toxic

CHRONIC TOXICITY:

CARCINOGENICITY: EPA Group E - No evidence of human carcinogenicity.

DEVELOPMENTAL/REPRODUCTIVE: No adverse effects.

MUTAGENICITY: No adverse effects.

HAZARD: The end-use product labels for the imazapyr formulations carry the *Caution* signal word due to potential eye and skin irritation.

VI. HUMAN HEALTH EFFECTS

ACUTE TOXICITY (POISONING):

REPORTED EFFECTS: None.

CHRONIC TOXICITY:

REPORTED EFFECTS: None.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM CONTACTING OR CONSUMING TREATED VEGETATION, WATER OR ANIMALS: None reported.

POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM INERT INGREDIENTS CONTAINED IN THE FORMULATED PRODUCTS: None.

HEALTH EFFECTS OF EXPOSURE TO FORMULATED PRODUCTS: Dermal sensitizer in some applicators after prolonged and repeated contact with formulated products.

HEALTH EFFECTS ASSOCIATED WITH CONTAMINANTS: None reported.

HEALTH EFFECTS ASSOCIATED WITH OTHER FORMULATIONS: None reported.

VII. SAFETY PRECAUTIONS

SIGNAL WORD AND DEFINITION:

IMAZAPYR - **CAUTION** – HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. AVOID BREATHING SPRAY MIST. AVOID CONTACT WITH SKIN, EYES OR CLOTHING. PROLONGED OR FREQUENT EXPOSURE TO SKIN MAY CAUSE ALLERGIC REACTIONS IN SOME INDIVIDUALS.

PROTECTIVE PRECAUTIONS FOR WORKERS: Applicators and other handlers must wear long-sleeved shirt and long pants, shoes plus socks.

MEDICAL TREATMENT PROCEDURES (ANTIDOTES):

EYES: Flush eyes with water.

SKIN: Wash all exposed areas with soap and water, call physician if irritation persists.

INGESTION: Drink 1 to 2 glasses of water and induce vomiting. Call physician.

INHALATION: Remove to fresh air. Call a physician if breathing difficulty persists.

HANDLING, STORAGE AND DISPOSAL: Store at room temperature or cooler. Do not reuse container. Rinse container and dispose accordingly.

EMERGENCY SPILL PROCEDURES AND HAZARDS: Contain and sweep up material of small spills and dispose as waste. Do not contaminate water, food, or feed by storage or disposal.

VIII. DEFINITIONS

adsorption – the process of attaching to a surface

avian – of, or related to, birds

CAEPA – California Environmental Protection Agency

carcinogenicity – ability to cause cancer

CHEMTREC – Chemical Transportation Emergency Center

dermal – of, or related to, the skin

EC_{50} - median effective concentration during a bioassay

ecotoxicological – related to the effects of environmental toxicants on populations of organisms originating, being produced, growing or living naturally in a particular region or environment

FIFRA – Federal Insecticide, Fungicide and Rodenticide Act

formulation – the form in which the pesticide is supplied by the manufacturer for use

half-life – the time required for half the amount of a substance to be reduced by natural processes

herbicide – a substance used to destroy plants or to slow down their growth

Hg – chemical symbol for mercury

IARC – International Agency for Research on Cancer

K(oc) – the tendency of a chemical to be adsorbed by soil, expressed as: K(oc) = conc. adsorbed/conc. dissolved/% organic carbon in soil

LC_{50} – the concentration in air, water, or food that will kill approximately 50% of the subjects

LD_{50} – the dose that will kill approximately 50% of the subjects

leach – to dissolve out by the action of water

mg/kg – weight ratio expressed as milligrams per kilogram

mg/l – weight-to-liquid ratio expressed as milligrams per liter

microorganisms – living things too small to be seen without a microscope

mPa – milli-Pascal (unit of pressure)

mutagenicity – ability to cause genetic changes

NFPA – National Fire Protection Association

NIOSH - National Institute for Occupational Safety and Health

NOEL - no observable effect level

non-target – animals or plants other than the ones that the pesticide is intended to kill or control

OSHA - Occupational Safety and Health Administration

Pa – Pascal (unit of pressure)

persistence – tendency of a pesticide to remain to remain in the environment after it is applied

pesticides – substances including herbicides, insecticides, rodenticides, fumigants, repellents, growth regulators, etc., regulated under FIFRA

PPE – personal protective equipment

ppm – weight ratio expressed as parts per million

residual activity – the remaining amount of activity as a pesticide

T&E – Threatened and Endangered Species (from the Endangered Species Act)

µg – micrograms

volatility – the tendency to become a vapor at standard temperatures and pressures

IX. INFORMATION SOURCES

American Cyanamid Company, Arsenal© Herbicide, Specimen Product Label, PE-11004, December 1999

American Cyanamid Company, Arsenal© Herbicide, Material Safety Data Sheet, AG09107-5, January 5, 1999

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American Cyanamid Company, Arsenal© Railroad Herbicide, Specimen Product Label, PE-11251, December 1999

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American Cyanamid Company, Chopper© Herbicide, Specimen Product Label, PE-19000, February 2000

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EPRI, Determination of the Effectiveness of Herbicide Buffer Zones in Protecting Water Quality, EPRI Final Report TR-113160, 1999

Extension Toxicology Network, Pesticide Information Profile, Imazapyr, 1996
http://ace.orst.edu/info/extoxnet/pips/ghindex.html

Extension Toxicology Network, Toxicology Information Briefs: Bioaccumulation, Revised 1993, http://ace.orst.edu/info/extoxnet/tibs/bioaccum.htm

Spray Drift Task Force, A Summary of Ground Application Studies, 1997 http://www.agdrift.com/publications/Body.htm

USDA Forest Service, Pesticide Fact Sheet, Imazapyr, November 1995
http://www.fs.fed.us/foresthealth/pesticide/index.html

X. TOXICITY CATEGORY TABLES

TABLE I: HUMAN HAZARDS

Category	Signal Word	Route of Administration			Hazard	
		Acute Oral LD_{50} (mg/kg)	Acute Dermal LD_{50} (mg/kg)	Acute Inhalation LC_{50} (mg/l)	Eye irritation	Skin irritation
I (Highly Toxic)	**DANGER (poison)**	0–50	0-200	0-0.2	corrosive: corneal opacity not reversible within 7 days	corrosive
II (Moderately Toxic)	**WARNING**	>50–500	>200-2000	>0.2-2	corneal opacity reversible within 7 days; irritation persisting for 7 days	severe irritation at 72 hours
III (Slightly Toxic)	**CAUTION**	>500-5000	>2000-20.000	>2-20	no corneal opacity; irritation reversible within 7 days	moderate irritation at 72 hours
IV (Practically Non-toxic)	**NONE**	>5000	>20,000	>20	no irritation	Moderate irritation at 72 hours

After *Pesticide User's Guide*, Ohio State University, Extension Bull. No. 745, 1998.

TABLE II: ECOTOXICOLOGICAL RISKS TO WILDLIFE (TERRESTRIAL AND AQUATIC)

Risk Category	Mammals Acute Oral LD_{50} mg/kg)	Avian Acute Oral LD_{50} (mg/kg)	Avian Acute Dietary LC_{50} (mg/kg)	Fish or Aquatic Invertebrates Acute Concentration LC_{50} (mg/l)
Very Highly Toxic	<10	<10	<50	<0.1
Highly Toxic	10-50	10-50	50-500	0.1 – 1
Moderately Toxic	51-500	51-500	501-1,000	>1 – 10
Slightly Toxic	501-2,000	501-2,000	1,001-5,000	>10 – 100
Practically Non-toxic	>2,000	>2,000	>5,000	>100

Table II created from information contained in *Pesticides and Wildlife*, Whitford, Fred, et al., Purdue University Cooperative Extension Service PPP-30, 1998.

Disclaimers and Other Legal Information:

Mention of a trademark, vendor, technique, or proprietary product does not imply or constitute an endorsement of the product by the United States Department of Energy - Bonneville Power Administration (USDOE-BPA), its employees, and its contractors, and does not imply or endorse any product to the exclusion of others. In all cases, the user is required by law to follow all pesticide label instructions and restrictions.

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